

Claims

1. An apparatus for subjecting a fluid to irradiation by high intensity ultrasound, the apparatus comprising a generally cylindrical vessel (12, 32), and a multiplicity of ultrasonic transducers (14) attached to a wall of the vessel in an array that extends both circumferentially and longitudinally so as to radiate ultrasonic waves at a frequency above 10 kHz into a fluid in the vessel, characterised by the vessel (12, 32) being large enough that each transducer (14) radiates into fluid at least 0.1 m thick, each transducer (14) being connected to a signal generator arranged so the transducer radiates no more than 3 W/cm^2 , the transducers (14) being sufficiently close to each other, and the number of transducers (14) being sufficiently high, that the power dissipation within the vessel (12, 32) is at least 25 W/litre but no more than 150 W/litre.
2. An apparatus as claimed in claim 1 wherein the power radiated by each transducer (14) is in the range $1\text{-}2 \text{ W/cm}^2$.
3. An apparatus as claimed in claim 1 or claim 2 wherein the number of transducers (14), the power of the transducers (14), and the volume of the vessel (12, 32) are such that the power density is between 40 and 80 W/litre.
4. An apparatus as claimed in any one of the preceding claims wherein the vessel (32) is double walled, the transducers (14) being attached to the outer wall (35), the fluid to be treated is enclosed within the inner wall

(32), and the space (36) between the two walls (32, 35) is filled by a low attenuation buffer liquid whose cavitation threshold is above that of the liquid to be treated.

5. An apparatus as claimed in any one of the preceding claims comprising a plurality of ultrasonic signal generators, each signal generator being arranged to energise a separate group of the transducers.

6. An apparatus as claimed in claim 5 wherein, in each said group, the transducers are adjacent to each other.

7. An apparatus as claimed in claim 5 or claim 6 wherein at least one group of the transducers resonates at a different frequency to other groups of the transducers, and each signal generator is arranged to energise the respective group of the transducers at their resonant frequency.